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ABSTRACT

Reported is a study related to effective teaching strategies for science instruction in northern Manitoba schools, which considered the importance of recognizing the culture and environment in which instruction takes place. The study described postulated that certain teaching strategies, when used for science instruction with native children, will maximize both achievement and attitude toward science instruction. Sixteen student teachers were participants in the study and the students consisted of native Indian children from 25 classrooms in eight different northern schools; grades included were 4 to 11. Six different strategies were implemented at various cognitive levels. Analysis of data for grades 4 to 6, as well as 7 to 11, indicated the most frequently used strategy (questioning) was least liked by native children. Student achievement using this strategy was reasonably high, and very high for students in grades 7 to 11. The most successful strategies used with the elementary children were the experimental approach and activity sessions; for the secondary group, information-centered assignments and questioning. The least successful for both groups was values discussion. (Author/EB)

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Strategies for Science Instruction with Native Children in Northern Manitoba Schools

by

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Introduction

Many of the graduates of teacher training institutions in Manitoba will, at some time in their teaching career, find employment in northern schools where the culture of the native people is dominant. The University of Manitoba teacher training programs, however, are not designed for teachers who will teach in northern communities. The major purpose of this study was to identify those teaching strategies which are most effective for science instruction in northern Manitoba schools and if possible incorporate these methods into the teacher training programs.

Rationale for the Study

Teaching methods must take cognizance of the culture and environment in which instruction takes place. This statement, while generally accepted by educators, is often ignored in the education of culturally different groups. The majority of the students in northern Manitoba schools are either Treaty Indians or Métis. Our experience gained through the supervision of student teachers in native schools has indicated that those teaching strategies regarded as appropriate for the teaching of children in rural and urban communities of southern

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Manitoba may not be effective in northern schools[1]. Kalra[2], in working with native children in British Columbia, also recognized that problems exist in motivating Indian children. As a result, he suggested a strategy of value-clarification using culturally relevant material. We believe that there are several strategies which may be especially effective with Indian children. This belief was fundamental to this study.

Design of Study

Sixteen student teachers were selected to teach for a five-week period in northern Manitoba schools. Prior to this teaching experience each student teacher reviewed and practiced six distinct teaching strategies. The six strategies were organized under four major categories: -

A. The rational approach - the teacher directs the students through questioning to a generalization by the use of reason. Most commonly the teacher asks questions and reinforces the students' answers until the desired generalization is reached. The initial point of focus might be a discrepant event, story situation or demonstration. Discussion will follow as a whole class or in small groups. The teacher would then lead the class to consider the solutions suggested.

   A-1 Demonstration-Questioning
   A-2 Values Discussion

B. The guided discovery approach - the teacher guides the students to take an active part in discovering relationships among observed phenomena. The structure may be fairly tight or relatively open-ended.

   B-1 Activity Centers
   B-2 Activity Sessions.

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1. Grunau, H., Leith, S., and Slentz, K. Northern Studies Teaching Experience and Curriculum Development Project Report, given at the Northern Studies Symposium, University of Manitoba, October 19, 1974.

2. Kalra, R.M. Science Taught with a Focus on Values. Journal of American Indian Education, Vol. 14, No. 2, Jan. 1975, pp. 21-25.

C. The experimental approach - with the assistance of the teacher, the students experience the scientific method - establish the problem, identify the hypotheses, plan the experiment, perform the experiment, assess the data, and report on the findings with respect to the hypotheses.

C- Group Problem Solving

D. The information-centered assignment - this strategy can be a follow-up to any of the other strategies. The student will be assigned to work independently and search out information about a topic. It may be a step in an Inquiry-Concept-Information sequence.

D- Individual Assignment

These six strategies had previously been identified as those most frequently used by teachers of native children[3]. Each student teacher implemented a number of the strategies at various cognitive levels and collected data as to the students' achievement and attitudes towards the instructional strategy. The sample consisted of 400 children from twenty-five classrooms in eight northern schools. Grades four to eleven were represented.

Each student teacher was supervised by a Faculty of Education staff member. The staff member's observation of the student teacher's use of strategies complemented the study. The questions considered by the study were:

1. Which of the identified strategies did the student teachers find the greatest opportunity to use?
2. What were the students' attitudes as measured by the Attitude Toward Science Strategy Scale toward each of the selected teaching strategies?
3. What was the mean perceived success for each of the six teaching strategies?
4. What was the relationship between the students' attitudes and mean perceived success for each of the six teaching strategies?

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3. Grunau, H., Leith, S., and Slentz, K., op. cit.

5. What was the frequency of use of each of the strategies for each level of instructional objectives?

6. How did the perceived success compare with the cognitive level of the objectives relative to each teaching strategy?

7. How did the mean perceived success for the affective objectives relate to each teaching strategy?

Two comparable attitude scales were developed by the authors for measuring the students' attitudes towards the teaching strategies. The grade four to six instrument used "sad-to-happy" faces on a Likert-type scale, whereas the grade seven to eleven instrument used descriptive terms which were parallel to those on the grade four to six scale. Both attitude scales of this Attitude Toward Science Strategy Scale were administered to all children in the study as a post test. Achievement was determined by teacher constructed tests.

Data and Interpretation

Question one asked: which of the identified teaching strategies did the student-teachers find the greatest opportunity to use? Table 1 presents the frequency and percentage of use for each of the six strategies for elementary and secondary teaching. We note that the most frequently used strategy for both elementary and secondary teachers was A-1 (Demonstration-Questioning).

Table 1

Use of the Teaching Strategies

	Elementary		Secondary	
Strategy	Frequency	Percentage	Frequency	Percentage
A-1	40	40	124	52
A-2	2	2	12	5
B-1	8	8	10	4
B-2	21	21	40	17
C	14	14	10	4
D	16	16	41	17
N=	N=101		N=237	

Question two asked: what were the students' attitudes as measured by the Attitude Toward Science Strategy Scale for each of the six tracing strategies? Table 2 presents the mean of each attitude for each of the six strategies.

Table 2

Attitude Toward the Teaching Strategies

	Elementary		Secondary	
Strategy	Mean*	Rank Order	Mean*	Rank Order
A-1	3.8	4	3.2	5
A-2	4.0	3	4.0	1
B-1	4.3	2	3.3	4
B-2	4.5	1	3.8	2
C	4.5	1	3.4	3
D	3.8	4	4.0	1

*Means from Attitude Toward Science Strategy Scale range from 0 to 5.

Queston three asked: what is the mean perceived success for each of the six strategies? Table 3 indicates the average perceived success. Strategy C for elementary students (Group Problem Solving) was perceived to be the most successful. Individual Assignments (D) was the most successful strategy for secondary students. For both elementary and secondary students the least successful teacher strategy was A-2 (Values Discussion).

Table 3

Perceived Success of the Teaching Strategies

	Elementary	Secondary
Strategy	*Mean Perceived Success	*Mean Perceived Success
A-1	6.8	7.1
A-2	5.0	3.7
B-1	5.5	6.5
B-2	6.6	7.2
C	7.1	6.6
D	5.5	8.3

*Means from teacher-made tests or estimated success on a scale of 0 to 10.

Queston four asked for the relationship between the students' attitudes and the average perceived success. In order to answer this question, a Pearson Product Moment correlation was applied to indicate the relationship between students' attitude and perceived success. For elementary students $r=0.22$ and for secondary students $r=-0.20$. Both correlations are low, indicating little relationship between these factors. Table 4 illustrates the students' attitudes and corresponding perceived success for each teaching strategy.

Table 4

Students' Attitudes and Perceived Success

	Elementary		Secondary	
Strategy	Attitude*	Perceived Success**	Attitude*	Perceived Success**
A-1	3.8	6.8	3.2	7.1
A-2	4.0	5.0	4.0	3.7
B-1	4.3	5.5	3.3	6.5
B-2	4.5	6.6	3.8	7.2
C	4.5	7.1	3.4	6.6
D	3.8	5.5	4.0	8.3

*Means from Attitude Toward Science Strategy Scale range from 0 to 5.

**Means from teacher-made tests or estimated success on a scale of 0 to 10.

Question five asked for the frequency of use of each strategy for each objective level for both elementary and secondary students. For both elementary and secondary students strategy C-1 (Knowledge Level) was most frequently stated. See Table 5. The strategy most frequently applied for this level of objective was A-1 (Demonstration-Questioning). Strategy D (Individual Assignment) was also frequently used for this objective level for secondary students.

Table 5

Frequency of Use of Instructional Objectives

and the Strategies Used to Implement Them

	Level of Objectives					
	Cognitive				Affective	
Strategy	C-1	C-2	C-3	C-4		Teaching Level
A-1	16	2	12	12	20	Elementary
	49	19	27	4	1	Secondary
A-2	1	-	-	-	1	Elementary
	2	-1	3	1	1	Secondary
B-1	2	1	1	0	0	Elementary
	7	-	4	-	-	Secondary
B-2	3	1	3	0	6	Elementary
	13	5	14	2	0	Secondary
C	7	5	14	7	8	Elementary
	2	4	3	-	-	Secondary
D	4	1	5	1	2	Elementary
	30	3	8	-	-	Secondary
Total	136	42	94	27	39	

C-1 Knowledge
C-2 Comprehension
C-3 Application
C-4 Synthesis, analysis and evaluation

} Bloom's Classification of Objectives

Question six sought to compare the mean perceived success to the cognitive objective level for each of the teaching strategies for both elementary and secondary students. Table 6 indicates the mean perceived success for each of cognitive levels. Because some teachers tended to concentrate on certain strategies for particular cognitive levels and because some teachers did not determine a measure of success for each objective this table only serves as a rough estimate of which strategies succeed best at particular cognitive levels.

The elementary teachers tended to perceive greater success when operating at the higher cognitive levels with strategy C and D whereas the secondary teachers perceived greater success at cognitive level 3 with strategies B-2, C and D, and cognitive level C-1 with strategies A-1, B-2 and D. Both groups were least successful with strategy A-2 (Values Discussion).

Table 6

Perceived Success as Cognitive Level of the Objectives for Each Teaching Strategy

	C-1		C-2		C-3		C-4	
Strategy	Elem.	Sec.	Elem.	Sec.	Elem.	Sec.	Elem.	Sec.
A-1	7.6	8.3	8.0	7.2	5.8	7.1	3.3	3.9
A-2	5.0	0.4	-	1.0	-	3.5	-	5.0
B-1	6.5	8.7	4.0	-	9.0	2.5	3.0	-
B-2	7.0	8.4	9.0	5.2	4.6	7.3	9.0	4.5
C	7.3	4.5	6.2	5.8	6.7	9.3	8.4	-
D	3.8	8.4	7.0	7.0	7.6	8.4	7.0	-

Means from teacher-made tests or estimated success on a scale of 1 to 10.

Question seven asked how the mean perceived success of the affective objectives relates to the teaching strategy. From Table 7 it is apparent that the secondary teachers rarely stated affective objectives - only for the A-1 (Demonstration-Questioning) strategy and there with only moderate success. The elementary teachers frequently stated affective objectives, especially for strategy A-1 (see Table 5). They perceived themselves as being relatively successful, especially with strategy D (Individual Assignment).

Table 7

Perceived Success with Affective Objectives

for the Teaching Strategies

	Affective Objectives	
Strategy	Elementary	Secondary
A-1	7.3	5.0
A-2	5.0	-
B-1	-	-
B-2	7.5	-
C	5.8	-
D	9.0	-

Means from teacher-made tests or estimated success on a scale of 1 to 10.

Results and Conclusions

Analysis of the data for grades 4 to 6 indicated that the most frequently used strategy (Demonstration-Questioning) was least liked by native children. However, the student achievement as a result of this strategy was reasonably high. The data for grades 7 to 11 also indicated that Demonstration-Questioning was most frequently used; this strategy was also least liked by this group. Also, the student achievement for this strategy was high. The most successful teaching strategies used with the elementary children were the Group Problem Solving and Activity Sessions, whereas the most successful strategies for the secondary group were Individual Assignments and Demonstration-Questioning. The least successful strategy for both the elementary and secondary children was Values-Discussion.

The strategies which bring about the greatest achievement at lower cognitive levels for elementary children were Demonstration-Questioning and Group

Problem Solving; for higher cognitive levels the strategies were Activity Centers, Activity Sessions and Group Problem Solving. The strategies which brought about the greatest achievements at lower cognitive levels for secondary children were Activity Centers, Activity Sessions and Individual Assignments; for higher cognitive levels the best strategies were Group Problem Solving and Individual Assignments. The most successful strategy for the affective domain at the elementary level was the Individual Assignment.

The study failed to establish a significant relationship between students' attitudes and perceived success.

From the study it appears that certain strategies - Demonstration-Questioning, Activity Sessions and Group Problem Solving - are suitable for the instruction of native children in elementary school. For secondary native children, Activity Centers and Sessions, Group Problem Solving and Individual Assignments were successful strategies. Therefore it seems reasonable to emphasize these strategies in our teacher training program.